STUDY PROJECT

A SYSTEM CONCEPT TO SUPPORT A COMMAND AND CONTROL DECISION SUPPORT SYSTEM FOR THE U.S. ARMY WAR COLLEGE

BY

LIEUTENANT COLONEL RAYFORD M. EUBANKS
United States Army

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USAWC MILITARY STUDIES PROGRAM PAPER

A SYSTEM CONCEPT TO SUPPORT A COMMAND AND CONTROL DECISION SUPPORT SYSTEM FOR THE U.S. ARMY WAR COLLEGE

AN INDIVIDUAL STUDY PROJECT

by

Lieutenant Colonel Rayford M. Eubanks
United States Army

Lieutenant Colonel Ronald E. Jones
Project Adviser

U.S. Army War College
Carlisle Barracks, Pennsylvania 17013

ABSTRACT

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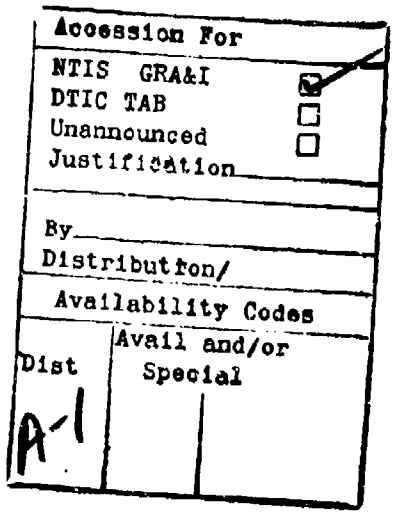

CHAPTER I

INTRODUCTION

The Army should be using the same models or at least models with the same analytical underpinnings for combat developments, training and education purposes. The U.S. Army Research Institute for the Behavioral and Social Sciences recommends that models used for command and staff training and education be based "upon a systemic analytical wargame."[1] General Maxwell Thurman, while he was the commander of the United States Army Training and Doctrine Command (TRADOC), stated "we should use the same models in training and education as we use in our combat developments work." General Thurman knew that the Army was (and still is) using one set of computer models and simulations to conduct studies and perform analyses for combat development efforts and simultaneously using other models and simulations for training and education purposes. Cost and Operational Effectiveness Analyses (COEA) are performed by TRADOC to examine the effectiveness of proposed weapon systems versus current weapons systems. The wargames used in the COEA will yield a set of results indicating how all systems performed. Results of these wargames are provided to decision makers to be used in the process to decide whether a proposed system would be bought. Simultaneously, models and simulations used to train and educate our battle staffs (company through corps) yield a different set

of results and suggest different contributions and levels of effectiveness for the gamed systems.

Wargames and models used by the U.S. Army War College (USAWC) to support the curriculum should be the same as those used by the Army. If that is not practical, then models that yield similar results should be used. This serves two very important purposes. First, it educates students in the future environment in which they will be required to operate and function. Second, it will enhance the college's effort to "become the focal point for strategic wargaming for the Department of the Army."[2] In this regard, General Carl E. Vuono, Army Chief of Staff, has directed the USAWC to "take the lead in the wargaming arena for the Army; to develop a preeminent wargaming center for the U.S. Armed Forces that responds to the needs of the warfighting commanders-in-chief (CINCs) and their Army Component commanders; to provide analytical wargaming support to the Army; and to use wargames as a mechanism for teaching."[3] The ability of the USAWC to accomplish these tasks and be a wargaming focal point for the Army will depend in large part on the wargames, simulations and models used for analysis and instructional purposes and the automated systems used to support these endeavors.

IMPORTANCE OF SIMULATIONS AND WARGAMES

> Computer based, simulated scenarios offer the only practical and affordable means to improve the training of joint operational commanders, their staffs and the commanders and staffs who report to them. Such decision makers need the opportunity to examine their decision skills, to test war plans and to train to work as a closely coordinated force.[4]

This statement by the Defense Science Board captures the essence of the importance of simulations and wargames to senior commanders and their staffs. As technology changes the future battlefield in both dynamics and sophistication, commanders will need to act more quickly and decisively. Commanders will be faced with multiple options and scenarios and will have less margin for error in dealing with changing situations. Computer wargames provide a way to train commanders and staffs in various aspects of command and control with minimum expense and increased flexibility.[5]

Computer simulations are becoming more important in today's Army as we develop techniques and methods to maintain a well trained force with reduced funding, complex weaponry and restrictions on manpower. The challenge to the Army is even more demanding in today's complex, multipolar world. No matter how demanding the task or complex the world, the Army must maintain a credible combat force. Computer simulations present a way to assist in the accomplishment of this requirement. Simulations can provide quality education at all levels of command and save

money, the environment and equipment.[6]

Validated simulations can become valuable assets to their organizations. Such simulations institutionalize knowledge, reduce field experiments and compare alternatives economically. Simulations will become valuable assets if they contribute to the organization's goals and if they are affordable to acquire and maintain. Simulations offer the capability to experiment with and manage change at small cost. Various alternatives can be examined, studied and modified through simulations and provide valuable and responsive information to decision makers.[8]

U.S. ARMY WAR COLLEGE NEED

The USAWC "prepares senior leaders to operate in a strategic environment by ensuring they understand the role of an Army officer in a democratic society; can advise our national command authorities on the use of military forces to achieve national objectives; and are adept at the use of military force to achieve national objectives if this should become necessary."[9] The USAWC curriculum is based upon this concept. The USAWC will have a new Strategic Wargaming Facility in 1994 and the capability to conduct simulations and gaming in support of the curriculum and student activities will be greatly increased. The USAWC also expects to become the focal point for strategic wargaming for the Army.

The USAWC expects to accomplish these goals through educational activities, conducting training and providing

analytical support. Educational activities will include not only USAWC curriculum support, but also support of the General Officer Joint Warfighting Course, support for outside agencies, special wargaming support (e.g., Army Chief of Staff requests, conferences, support to a CINC) and support for faculty development projects. Specific wargaming training will be conducted for selected students who have a desire or requirement for more in-depth knowledge and for special requests from Army agencies. Analytical support will be provided to internal USAWC activities (e.g., student projects and studies, the Strategic Studies Institute); to support a request from a CINC or Army Component Commander (e.g., war plan analysis); to support the Army Staff; and to support the requests from TRADOC analysis organizations and schools.[3]

To support these educational activities and conduct responsive training, an interface system will be required between the wargame, model or simulation and the user. The USAWC calls this interface system a Command and Control Decision Support System (C2DSS). The following statement addresses the need for such a system.

> There is a pressing requirement for a system that will allow faculty and students to interface/interact directly or indirectly with models, decision aids/tools, databases and the like during the application phase of instruction, i.e., gaming, simulations and exercises. The capability to interface with gaming models and databases emulates certain command and control processes and decision support (coordinating staff) functions such as providing information, making estimates and recommendations, preparing plans, orders, messages and reports and supervising the

> execution of orders. This system will assist and augment the user's ability to fuse information, analyze, compare and evaluate options, and display information in a format so that wise decisions can be made quickly. To the extent possible, this system should replicate command and control decision support systems used by the joint community."

The gaming and instruction in support of student activities must have an architecture for student interface that is both realistic and responsive. This architecture, which is called C2DSS, must be designed to gain maximum student benefit from the models and support other USAWC efforts. Ideally, the student will have available the same type information and use the same or similar models used by the Army staff, Army major commands and commanders-in-chief (CINC).

PURPOSE AND SCOPE

The purpose of this study is to develop an umbrella architecture for a command and control decision support system that supports the requirement for simulations, gaming and exercises at the USAWC. This umbrella architecture will not be a system design, but rather a three dimensional system concept which will support the C2DSS.

In order to develop this system concept, the following research was conducted: research all facets of wargaming and simulations at the USAWC, from historical and current capabilities to the USAWC requirements and wargaming philosophy; research into the requirements, needs and capabilities of a

strategic leader - a CINC - as they apply to a C2DSS and the USAWC education process; research current and developing automated technologies that assimilate, process and display information for decision making. This research was necessary to develop the system concept to support the C2DSS.

This paper was written from the viewpoint that students should be educated using the same or similar tools and techniques (models, simulations, decision support systems, command and control systems, wargames, exercises, etc.) used by the Army and other Department of Defense activities. A similar tool is one that provides students a close approximation of the results the actual tool would provide under the same circumstances. Obviously, due to the size, complexity and overhead requirements of some tools, it would be impractical to use them at the USAWC (e.g., some tools are too large to reside on the USAWC computer system, some tools require many analysts to maintain, other tools require long run times).

ENDNOTES

1. U.S. Army Research Institute for the Behavioral Sciences, Design of Battle Simulations for Command and Staff Training, p. 34.

2. U.S. Army War College, U.S. Army War College Action Plan Update - 1990, p. 13. (hereafter referred to as "Action Plan Update")

3. Carl E. Vuono, General, U.S. Army War College Terms of Reference, pp. 1-2.

4. Office of the Under Secretary of Defense for Acquisition, Report of the Defense Science Board Task Force on Computer Applications to Training and Wargaming, p. 1. (hereafter referred to as "Defense Science Board Report")

5. Robert K. Ackerman, "Simulation for Training Military Leaders", SIGNAL, August 1989, p. 57.

6. John W. May, Jr., LTC, Computer Simulations and the Army War College, Where are the Games?, p. 1.

7. David S. Hendrickx, "Simulation Systems: A New Role in Executive Decision Making", SIGNAL, July 1988, p. 73.

8. Hendrickx, p. 71.

9. Action Plan Update, p. 1.

10. U.S. Army War College, CSW Wargaming Requirements Briefing, p. 6.

11. U.S. Army War College, Command and Control Decision Support System Requirements Definition Document (DRAFT), pp. 1-2. (hereafter referred to as "C2DSS Requirements Document")

CHAPTER II

WARGAMING AND SIMULATIONS AT THE USAWC

"Wargaming - the simulation of strategic and tactical problems to develop and hone military thinking - has proved, at the services' schools of advanced professional education, to be one of the most important payoffs of the modeling trend."[1] Wargames provide hands-on training and the ability to apply classroom principles in an environment which requires innovative decision making. Participants gain perspectives on procedural problems and insights into policy matters which are not obvious without hands-on applications. Wargaming different approaches to problem solving using automated technologies has the advantage that poor or wrong decisions do not result in the loss of life. In fact, a poorly developed plan which yields disastrous results through wargaming often results in valuable learning.[2]

Wargames can be effective learning tools because of the capability of personal instruction and role-playing. Students gain experience from being placed in a decision making role and obtain rapid feedback on the results of their decisions. By examining the decisions made by a student-player and determining why certain decisions were made, training can focus on the decision-making process.[3]

The Defense Science Board indicated that the use of

wargaming as a means to train and improve the decision making capabilities of joint warfighters is an excellent alternative. The Board further stated that "battle simulation is the only way commanders and staffs can gain experience with using certain weapon systems, sensors, tactics and techniques against a skilled adversary."[4]

WARGAMING PHILOSOPHY AT THE USAWC

Gaming at the strategic and operational level has always been an integral part of the USAWC curriculum. Various techniques and methodologies are and have been used to educate, examine alternatives, develop insights into issues and problems, aid in the decision making process and generate discussion among the staff, faculty and students.[5] The USAWC believes that wargaming provides an active learning method to help in the professional education of senior officers and civilian officials of the Department of Defense. Wargaming tends to enhance the education process in the art and science of joint warfare.[6] The USAWC further believes "that classroom learning, coupled with manual and computer-assisted wargames, is the appropriate methodology for the development of the concepts and professional skills necessary for our future leaders."[7]

This philosophy is translated into curriculum support and other actions which support the U.S. Army by the Center for Strategic Wargaming (CSW). The CSW has the mission to support

both the USAWC and the U.S. Army through joint/combined strategic and operational wargames and exercises. These wargames and exercises are developed by CSW from strategic and operational requirements.[8]

HISTORICAL PERSPECTIVES

Historians have broken down the history of wargaming into four distinct eras. The first era began before written history and concluded in the early 1800s and was considered the war-chess era. Participants played with chess-like pieces on boards with squares and moved according to set rules. Participants played these games for amusement and for training. The second era, lasting until around 1875, gave rise to manual games which were played on a map or some other form of terrain representation. These games were characterized by a set of strict rules which specified every aspect of play. These extensive rules resulted in slow play and came to be referred to as "rigid" wargames because of their strict rules. The third era lasted until just after World War I and was characterized by a less rigid set of rules and a more free form of gaming. An umpire replaced many rules and the free play led to faster games and permitted many previously excluded military considerations to become part of the game. The fourth distinct era, beginning after World War I and including the present, has been dominated by the extensive use of wargames in research. The use of computers in wargaming

applications has had a significant impact on the discipline as has the use of wargaming for peacetime planning and training.[9]

The USAWC has used wargaming in its curriculum in different degrees since the founding of the USAWC in 1901. For example, the wargame Kriegsspiel was being used by the Army War College in Washington, D.C. in 1914.[10] Kriegsspiel, literally translated, means war play or war game. It was one of the earliest wargames and was used extensively in the Prussian Army and later in the German Imperial Army. The game was later adapted by many other countries for use in army wargaming.[11]

> Historically, war gaming has played an important role in the curriculum of the Army War College. It was eliminated from the college in the early 1970's with the advent of studies that focused on the broad defense arena rather than war fighting. Begun again in the late 1970's, the process has struggled to find its identity and role in the War College.[12]

The Department of War Gaming at the USAWC began increased efforts at using computer based wargaming in 1981. With the expansion of the wargaming effort, the Department of War Gaming was expanded to become the Center for Land Warfare in 1983.[13]

In 1984 the USAWC participated in a research and development project being conducted by the Office of the Under Secretary of Defense for Research and Engineering (USDRE). USDRE was looking at computerizing defense processes and at the time was working on a concept for a model called TACPLAN. TACPLAN (TACtical PLANning) was to be a micro-computer based planning aid capable of assisting corps level operational planning. Prior to the

development of TACPLAN, USDRE conducted a series of requirements analyses. These analyses were to determine if the model should be built (was there a valid requirement) and what were the tasks the model could and should perform. This is a fundamental element of designing a computer-based aid of any kind. Six expert planners from the USAWC participated in a two-day experiment to solve a European defensive planning problem. Planners were videotaped as they developed their operational concepts which enabled the developers to study operational planning from different perspectives. This experiment and the observations it provided enabled the designers to develop an aid that portrayed the actual planning process. Additionally, observations of the videotape lead to the development of planning tasks which were used to design the interactive sequences built into TACPLAN.[14]

As a result of the tremendous progress made in wargaming technology and to maintain an up-to-date curriculum, the USAWC initiated an ambitious plan in 1988 to expand its wargaming capability. The Center for Land Warfare was also renamed the Center for Strategic Wargaming (CSW).[15] This plan called for the construction of a new strategic wargaming center with greatly enhanced capability to support student requirements and serve as the focal point for strategic wargaming for the U.S. Army.

PREVIOUS USAWC CURRICULUM WARGAMING AND SIMULATION EFFORTS

During the early to mid 1980s the USAWC used several computer-assisted exercises in the curriculum. For the most part, exercises were developed specifically for the USAWC curriculum. Even though these exercises have not been used for a number of years, three warrant discussion.

USAWC Student Strategic Mobility Model. The USAWC had a curriculum requirement to examine strategic mobility and develop insights concerning the deployment of forces to a Southwest Asia theater. Through a joint USAWC (Department of War Gaming) and contractor effort, the Force Assessment Deployment Simulation (FAST) was developed and placed in the academic year 1983 curriculum. FAST was the computer-assisted instructional tool used for the Student Strategic Mobility Model.

FAST allowed students to evaluate the capability to project forces into the theater with expected arrival times and logistics support. FAST was an interactive model which allowed students to change assumptions and conditions in order to investigate deployment strategies. The simulation contained many operational factors which affected deployment. Key factors included: the availability of different airlift assets; differences in the number and type of ships available on the U.S. east and west coasts; each type unit played had different equipment and logistics resupply requirements; sealift assets were available

for in-theater resupply and stockage.

FAST ran on a microcomputer and was designed with an interactive menu which did not require students to have computer experience. The simulation was controlled with an executive program which allowed students to describe a course of action; establish strategic deployment requirements and restrictions; prioritize forces to correspond to the desired course of action; and simulate force deployment to determine unit closure times. The model featured menus which presented available options and students would work their way through the various menus selecting options, inputting parameters and making assignments. All actions were accomplished via simple keyboard strokes. The simulation was then started and while running, the current status was displayed on the video screen for the student to observe. A hard copy of the results was provided and after analysis, changes could be made and the simulation run again.[16]

USAWC Student War Gaming Model. This model was a two-sided, computer-assisted simulation which could support a wargame in Europe and Southwest Asia at the strategic, operational and tactical levels. The game was played on maps with hexagonal grid and terrain overlays and a microcomputer was used to drive the game. Blue and Red units were represented by cardboard playing pieces and each type unit had attributes such as strength, movement speed and combat potential. The computer stored the large data base and game controllers had limited access to make changes.[17] This was the typical low resolution, computer-

assisted wargame of the early eighties and was cumbersome to work with and required excessive student training.

CONSCREEN II: A Contingency Planning Aid. CONSCREEN II (Operational CONcept SCREENing Aid, Version II) is an enhanced version of the original CONSCREEN developed under contract for the USAWC in 1982. Major differences in the two versions include the microcomputers used by each model and the techniques for user interaction with the model.

CONSCREEN II was a decision aid designed to support the USAWC curriculum in the area of contingency planning. It assisted planners in evaluating military courses of action and surfaced issues concerning the guidance, assumptions and forces in the Joint Strategic Capabilities Plan (JSCP). The student planner, after reviewing JSCP guidance, would select and specify at least two operational concepts, provide the key planning assumptions from the JSCP and furnish his judgments concerning each operational concept as they applied to the decision variables. CONSCREEN II would identify the best concept and indicate the assumption and judgment implications of selecting that concept. After an examination of the results, changes could be made and alternative concepts evaluated for sensitivities.[18]

Students worked their way through the aid with an elaborate system of menus and decision tables containing assumptions, decision factors and factor weights. The student required an understanding of these assumptions and factors in order to interpret model results.

WARGAMING AND SIMULATIONS - CURRENT CURRICULUM

As previously stated, the USAWC has used wargaming and simulation tools in its curriculum since the foundation of the college. Exercises are placed in the curriculum to support a learning objective or demonstrate a principle. The number of years an exercise remains part of the curriculum depends on a number of variables. These include student assessments and comments, whether the exercise remained current, plus the time and level of effort required by students to run the exercise. Academic year 1991 is different from any previous academic year in terms of how wargames and simulations supported the curriculum and future years will reflect changes from 1991.

An examination of the curriculum for academic year 1991 reveals some interesting facts. The curriculum is broken down into four core courses and elective courses. Core Course 1 (Strategic Leadership) and Core Course 2 (War, National Policy and Strategy) do not contain any wargaming or simulation exercises. Core Course 3 (Implementing National Military Strategy) contains two computer-assisted exercises. The first is the Theater Level Campaigning Exercise (Asia Minor 91), in which students develop a theater concept for the deployment of U.S. joint forces in conjunction with allied regional forces in support of U.S. strategic objectives. Students spend their time developing the campaign plan and discussing three courses of

action presented as part of the exercise. The faculty instructor selects one of the courses of action and that course of action is gamed using the Rand Strategy Assessment System (RSAS) computer model. (A description of RSAS and other models is presented later.) The RSAS run is made by the CSW after class and the next day the instructor briefs the results. Students then develop a sequel to their campaign plan. There is no student interface with the wargame or discussion of the model's capabilities and limitations. The second Core Course 3 computer-assisted exercise is the Mobilization Policy Exercise which uses an interactive computer model to examine Department of Defense manpower policymaking. This model - the Mobilization Policy Simulation Model - was developed by the Center for Strategic Wargaming. One student from each work group of seven students is given one hour of training on the menus, how to make changes to the already set-up base case, and how to run and print model results. Student groups decide on policy changes which are input into the model and run. Students examine the results in light of exercise guidance and continue to make policy changes until they are satisfied with the results. The model is used to compute costs and determine manpower levels. There is not a discussion of the model or any aspect of computer simulation. One student per group learns to navigate his/her way through the menus used by the model. Students do not gain an understanding of the model or its strengths and weaknesses. This can hinder the education process because of the lack of trust in the model and a lack of

appreciation of its capabilities.

Core Course 4 (Global and Theater Strategy Application) is scheduled to contain two computer-assisted exercises. One of these is an exercise using a model called the Force Budget Spreadsheet. This model develops an automated force structure and cost structure for major units in the Department of Defense. A student from each work group will be trained on how to navigate through the menu system, make changes and produce output. Students will then make changes to the force structure in order to meet budget guidelines. This exercise, in terms of automation, is similar to the Theater Level Campaigning Exercise in Course 3. The other Course 4 exercise is one in which students will develop a campaign plan. Additionally, one seminar's plan will be executed using the RSAS Model (as in Course 3) and one seminar's plan will be executed using the Theater Analysis Model (TAM). Again, as in Course 3, the sixteen other seminars will be presented the results of a pre-run campaign plan.

There were 84 Advanced Courses offered and only five treated wargames, simulations or computers. One of the courses was on the information management policies, procedures and future impacts on the Army. It was not a computer applications course. Another course, Joint Land, Aerospace and Sea Simulation (JLASS), used the Rand Strategy Assessment System (RSAS) wargame to "game" a student-developed campaign plan at the Air Force War Gaming Center in conjunction with other senior service college

students.[19] JLASS is a campaigning course and the students do not become familiar with the model or appreciate its strengths and weaknesses. This is a two term course and there is time in the schedule to educate the students on the RSAS model. The Wargaming Systems and Applications course examined wargames and models available for analysis and the evaluation of joint plans, as well as their strengths and weaknesses. This course covered a wide array of models and students gained an understanding for their use. In another course, Campaigning: Southwest Asia Theater, students were to develop a theater campaign plan for the Southwest Asia theater of war and the plan was to be executed on the Tactical Warfare (TACWAR) wargame by the CSW wargaming staff. However, this course was not taught due to a lack of student interest. The last course, Advanced Warfighting Studies Program, used the RSAS wargame in its Joint Warrior Exercise to explore the feasibility of a student-developed campaign plan. Results of the gaming were briefed by controllers/instructors and students did not interface with the model. Of the 84 Advanced Courses offered, only one course was offered in which students were taught something about wargames and simulations and gained an appreciation for the application, capabilities and limitations of this teaching method.[20]

USAWC CAPABILITIES

Wargaming and simulation support is provided to the core

curriculum and Advanced Courses by the Center for Strategic Wargaming (CSW). CSW offers computer-assisted wargames and exercises for this purpose and also provides assistance to faculty and students conducting research and study projects. Wargaming at the USAWC is at the strategic and operational level. The concept is that wargaming is used to exercise student campaign plans. Students do not interface with the wargame, rather, results are presented for discussion.

The CSW facilities are housed in the Land Systems Laboratory (LSL) which serves as the USAWC secure wargaming facility. The LSL houses all the hardware and software for wargaming and simulations. It also contains two small wargaming rooms, a secure conference room (which can seat approximately 20 persons), and offices for the staff. The staff (analysts and administrative personnel) develop data bases, test models and conduct the computer-assisted wargames.[11] The LSL does not have the capability to support more than two seminars (sixteen persons each) in the facility during computer-assisted curriculum exercises.

The LSL hardware suite consists of two minicomputers, a VAX 8810 and a MicroVAX 2000; and several microcomputers, including a SUN 3/260, an INTEL 310, a Compaq Pro 386, Macintosh, Zenith and WYSE PC's. These systems contain an array of programming languages and information management systems to suit the needs of students and the faculty. The wargaming and computer-assisted exercise capability is built around several application programs

residing on several of the pieces of hardware. These programs are the Tactical Warfare (TACWAR) Model, the Joint Theater Level Simulation (JTLS), the RAND Strategy Assessment System (RSAS), the Force/Budget Spreadsheet, the Manpower Mobilization Model and the Rapid Deployment Exercise (RADEX).

The TACWAR Model is a theater level wargame that models air and ground operations in conventional, chemical and nuclear environments in a single theater. TACWAR is a low resolution model which resolves combat at the division and separate brigade level. There are currently four versions of this wargame that run on a VAX minicomputer. The USAWC has the Central Command (CENTCOM) version. The Joint Staff/J8 uses TACWAR in theater level analysis and in the Total Force Capabilities Analysis (TFCA) and has made the model available to the warfighting CINCs through the Modern Aids to Planning Program (MAPP).

RSAS is a global wargame which models conventional air, ground and naval forces as well as strategic nuclear systems. The wargame runs on the SUN 3/260 system and was developed for the Office of the Secretary of Defense (Net Assessment) by the RAND Corporation. The wargame functions in multiple theaters and models up to the national command level through decision tables. Theaters available are Europe (including Turkey), Korea and Southwest Asia for this low resolution model.

The JTLS model is a theater level wargame used for developing and examining warplans containing conventional air, ground and naval forces and runs on a VAX minicomputer. The

model was jointly developed by the USAWC, the U.S. Army Concepts Analysis Agency and the former U.S. Readiness Command. Modeled units can range from squad to army group with typical scenarios using separate brigade and division units. JTLS is not being used to support the core curriculum or any Advanced Courses.

The RADEX Model is a contingency planning model used to examine strategic mobility issues and can simulate inter-theater mobility. The model was developed by the Air Force Institute of Technology for the Air War College and runs on any IBM PC-compatible computer. The model is interactive and allows the user to rapidly change a course of action and view results. RADEX is available for student and faculty use in research projects.

Both the Force/Budget Spreadsheet and the Mobilization Policy Models were developed by CSW to support the USAWC curriculum. Each model supports a different exercise and both allow students to rapidly change parameters and view results. Both applications run on the INTEL 310 system.[22]

USAWC FUTURE CAPABILITIES

The USAWC has a vision for the future. This vision is called USAWC 2000 and is a program which was developed to guide the USAWC through the process of becoming the Army's preeminent center for strategic thought by the year 2000. Teaching departments, other USAWC organizations and closely related on-

post activities have developed time-phased initiatives to directly support the USAWC 2000 vision. The USAWC has made several assumptions for the planning and implementation of USAWC 2000. A key assumption which impacts on future wargaming and simulation capabilities is that a new Strategic Wargaming Facility (SWF) will be constructed and fully operational by April, 1994.[23]

The need and concept for a SWF was derived from an assessment of the curriculum and from General Vuono's terms of reference for the USAWC. The SWF must be able to support the USAWC as the center for strategic thought; it must support Department of Army level missions and requirements; it must have the capability to conduct strategic level wargaming and simulations, and support symposia and conferences; and it must be capable of supporting the curriculum requirements. As the USAWC goes about satisfying these needs, it remains focused on senior leader development. The SWF will enhance the senior leader development process by enhancing learning, providing students the basic information necessary to understand the use of wargames and decision support systems, and by training selected students on the technical aspects of the use of wargames.[24]

Wargaming will be one focus of this process. Several capabilities are envisioned and being planned. Wargames will be conducted by seminars in both one- and two-sided games which will be controlled by a control cell. This capability does not now exist with the extremely limited size of the current LSL. A

class wargame is envisioned as a culminating exercise to demonstrate the capability to wargame at the strategic level. The SWF would also support an Army level or CINC level wargame for senior leadership conferences. There are many ways to use wargaming, simulations and computer-assisted exercises to enhance learning and support the curriculum.[25] For students, conference attendees and other users to get the most of each exercise, there needs to be some sort of decision support system, command and control system or expert system serving as the interface between the student/attendee and the model or control cell. This interface would allow information to be obtained, parameters changed, campaign plans input, etc. This system must be user friendly and flexible. The USAWC concept, as previously discussed in Chapter I, is the C2DSS. All this will take place in the SWF which will be a state-of-the-art facility for instruction, wargaming, exercises and conferences. The wargaming area in the SWF will be reconfigurable for seminar gaming, class gaming or other uses.

The CSW has developed time-phased initiatives in accordance with USAWC 2000. During the 1990-1992 period, CSW will develop tools for future wargaming, expand the capability to support the curriculum and expand wargaming activities (add Advanced Courses, expand Course 4 exercises, support outside agencies). From 1992-1994, CSW will continue to expand its wargaming capability in terms of personnel and technology and move into and operate the SWF. From 1994-1996, CSW will expand its external wargaming

activities (conduct an Army global game, provide training support to the Army staff, conduct management exercises and mobilization exercises), and formalize political-military gaming at USAWC. During the 1996-1998 period, CSW plans to become the Army's political-military gaming center and expand its strategic analytical support capability. From 1998-2000, CSW will be measuring its ability to develop models for the USAWC and the Army.[25]

USAWC SYSTEM REQUIREMENTS

CSW has identified the preliminary hardware and software requirements for the SWF. The hardware suite will retain the capability to run current software, add local area network hardware and add PC's, printers and other peripherals. The system must be capable of running models which support gaming (e.g., seminar, class), facilitate distributed gaming with other locations and support student analysis through good decision processes. An important fact is that the SWF will not include a main frame computer and any software (wargames, simulations, etc.) acquisitions must be capable of running on a mini or micro computer.

The CSW has identified both general and specific requirements for models/wargames which will be used in the SWF. Generally, the models should be appropriate for the study being performed; the models should relate to actual command and control

systems; and the models should provide results which are both reasonable for education purposes and detailed enough for analysis. The models should be responsive enough to provide fast turnaround; be both sustainable and maintainable; and be easy for analysts to operate.[28] More specifically, the models should model land, sea and air; provide timely and aggregated input and output; be able to play at the CINC (theater) or higher; contain graphics routines and output formats which are useable; allow for umpires (controllers/faculty instructors) to intervene to accomplish game objectives; and obtain data from a single source.[29]

USAWC C2DSS REQUIREMENT

As indicated by the statement of need for the C2DSS in Chapter I, to the extent possible, the C2DSS should replicate those systems currently used in the joint community. The C2DSS will provide interface between students/users and wargames, and models and simulations. Students must be able to input campaign plans into wargames from workstations located in seminar rooms and/or the SWF. These inputs will be accomplished through preformatted documents accessible by a pull-down menu. Other games/models/simulations will require students to evaluate courses of action and rapidly analyze results by calling up the application and interacting directly with the application through pull-down menus.[30]

The user interface for wargames and all other applications will be accomplished with the C2DSS. The C2DSS software interface between the student and the application will be accessed and manipulated with a workstation. The workstation consists of a display, keyboard and mouse. The C2DSS will "combine window, walking menus, direct manipulation of on-screen objects and user-friendly language to facilitate ease of operation."[30] The FAST model was an earlier attempt to have student interface with an application model through a menu system. Current examples of similar type menu systems include the Apple Macintosh menu and the RSAS menu system. The C2DSS will be a system which allows the user to obtain a wide variety of information from the application data base (e.g., unit status, order of battle, planning factors) and display it in easy to read tables and graphic features. Further, C2DSS will create decision support products, provide decision aids and regulate existing command and control processes where possible. These requirements are an indication of the framework for C2DSS; detailed requirements as well as the specific functions and features are contained in the Command and Control Decision Support System Requirements Definition Document.

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14. Stephen J. Andriole, Artificial Intelligence and National Defense: Applications to C3I and Beyond, pp. 143-155.

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24. U.S. Army War College, Strategic Wargaming Facility Briefing, pp. 1-3.

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26. U.S. Army War College, Center for Strategic Wargaming Time-Phased Initiatives, pp. 1-2.

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29. C2DSS Requirements Document, p. 2.

30. Ibid.

CHAPTER III

COMMANDER-IN-CHIEF REQUIREMENTS

Much of the USAWC curriculum is built around the responsibilities and operational methods of the commanders-in-chief (CINCs) and how they accomplish national military objectives. An integral part of CINC operational methods is the use of automated technologies. These technologies are used in different ways to support a variety of functions. As previously stated, to the extent possible, the C2DSS should replicate decision systems and aids which are in use by the CINCs. The wargames and simulations used by the CINCs and other Army and DOD agencies should be included in the software suite of the SWF where practical. Applications which are not practical would include those that will not fit or run on the SWF mini and micro computers; those that are too cumbersome for students to use; and those that require excessive resources (manpower and time) to maintain.

"The national military objective serves the national security goal of preserving the United States as a free nation with its fundamental limitations and values intact, while deterring war."[1] One method used by CINCs to carry out their national security objective responsibilities is to plan and organize for war during peacetime. Part of the planning process

includes the preparation of contingency plans. CINCs are tasked in the Joint Strategic Capabilities Plan to develop certain global and regional contingency plans and are provided a listing of the major combat forces available for this planning. CINCs use wargames and other automated technologies to help in this planning process.

THE CINCs INFORMATION NEEDS

> The future battlefield will be less and less forgiving of slow decisions. It will not be a place for cautious, bureaucratic centralizers glued to computer monitors waiting for one additional piece of information which will allow a "sure" decision to be made.[2]

This statement from the Army Command and Control Master Plan (AC2MP) carries many meanings and can be interpreted in many ways. It is taken from a discussion on "C2 Perspective" and is attributed to the current TRADOC commander, General John W. Foss. It was used to put his philosophy on command and control in the light of rapidly advancing information technology into the document. However, looking at the comment in a different light, it begs the question: What information does a commander need to assist him/her in the decision-making process and how should this information be displayed? Commanders at various levels need and use information differently. The information needs of a battalion commander are different from a CINC. The information needs at the battalion level are well known, but at the CINC

level, information needs are not as well known.

Joint Pub 6-0 is the doctrine publication for joint command, control and communications systems. This document tells the CINC to develop his plans to integrate the Defense Communications Systems (DCS), the National Communications System (NCS), commercial and allied systems and to organize his organic and component tactical communications systems into an interoperable and compatible network.[3] This tells the CINC that he has all the global communications systems available for his use as well as those systems brought into his area of operations by a component, allied or sub-unified commander.

One key system available to the CINC on a "non-interference basis" is the Worldwide Military Command and Control System (WWMCCS). The CINC uses WWMCCS on a non-interference basis because its primary mission is to support the National Command Authorities C2 function.[4] The WWMCCS systems consists of command facilities, tactical warning systems, communications capabilities to pass information, hold conferences and issue orders and executive aids. The executive aid capability allows the user to pass structured documents and reports and also allows interactive connections to enter data and receive pre-formatted information displays and forms. This could be a powerful decision aid to a CINC, depending, of course, on the CINCs requirements versus the information provided by WWMCCS.

At the global level, systems are in place to provide some support to the CINC. To a limited degree, this is also the case

at the theater level. Each component commander will bring into the theater organic assets which must be compatible and be capable of providing the CINCs critical information in a timely manner. The Navy has its Naval Communications System which provides communication support to the Navy on a world wide basis. A Naval Component commander relies heavily on this system. The Army is developing its Army Command and Control System (ACCS) which is a composite of several subsystems. There are other systems supporting each component commander and all these systems were developed without much joint coordination, if any. The current mix of communications, computers, sensors and downlinks which make up the C2 systems of joint/combined forces in the field today, derives from a collection of separately developed service components with an interoperability overlay.[5] In today's high technology battlefield environment a CINCs communications assets must be compatible.

CINCs obtain information from many sources that provide a wealth of knowledge ranging from reports to data bases. WWMCCS provides access to computer systems containing large data bases. The other national and regional command and control systems can provide more specific data. All services have administrative and logistics information systems which the CINC can access.[6]

With an abundance of information available, what are the critical information needs of a CINC? A more relevant question might be, how can information overload be avoided with the CINC or his staff and how do we make sure the right people get the

right information? Former Chairman of the Joint Chiefs of Staff, General John W. Vessey, once observed that it was clear to him that the Army was not employing command, control and communications in a disciplined manner to get the important information to the right people in a timely manner.[7]

CINCs develop their own critical information requirements and these requirements differ from CINC to CINC. CINCs use all elements of power - military, political, economic and informational - within their region as battlefield decision aids.[8] CINCs need a framework to help determine their critical information requirements and an automated procedure which formats the information in a manner which enhances their decision making process. The technology is available - an integrated and joint effort is required to harness the tremendous amount of information and through computer power and other techniques turn it into decision aids for the CINC.

CINC CAPABILITY

As part of the work in assessing the applications of new computer technology to joint training, exercises and wargaming, the Defense Science Board surveyed the Unified and Specified CINCs. This 1988 survey asked the CINCs to complete a questionnaire on computer applications related to training and wargaming. The Defense Science Board's main conclusions from the survey were that "the CINCs unanimously agree that more wargaming

automation support is needed, with the nature of this support ranging from simple data/report assimilations to more complex requirements such as artificial intelligence applications; and that there appears to be a relatively small amount of computer technology dedicated to supporting wargaming exercises which involve thousands of players at great cost."[9] This equates to a lack of capability to test courses of action for campaign plans and display information for command and control purposes in an efficient manner through graphical or other methods.

The Joint Operational Planning and Execution System (JOPES) is being developed under proponency of the Joint Chief of Staff Operational Plans and Interoperability Directorate (JCS J7). JOPES will be an integrated command and control system designed to satisfy senior commanders' information needs in support of joint planning and operations. JOPES will be a planning tool which will coordinate mobilization, deployment, employment and sustainment activities for a senior commander. This will be accomplished through seven interrelated functions, one of which is simulation and analysis. Simulation and analysis will be accomplished through applications such as force-on-force assessments, force requirements determinations and requirements versus capabilities analysis. Early versions have been fielded and enhanced versions are scheduled to be fielded in 1991 through the mid 1990s.[10]

The Worldwide Military Command Control System (WWMCCS) Automatic Data Processing (ADP) Modernization (WAM) program is an

improvement to the existing WWMCCS and is designed to correct existing deficiencies in command and control systems. These deficiencies include the lack of a standard force status monitoring capability, the lack of automated support to multiple planning scenarios and the lack of an on-line system to modify plans. The WAM effort is focusing on the JOPES requirements and will be fielded in versions much like JOPES.[11] The WAM effort will deliver critical products (hardware and software) to CINCs and other high level commanders to satisfy their information and command and control requirements. CINCs will be able to rapidly determine unit status, determine force sustainment capabilities and limitations, as well as to track unit mobilization and deployment.

The Modern Aids to Planning Program (MAPP) is a joint JCS and CINC initiative to acquire and field wargames, simulations and analytical software for the purpose of improving joint operations plans. The CINCs will have a capability to conduct theater level wargames, support JOPES with computer-assisted analysis and have a basis for resource decisions. The Joint Theater Level Simulation (JTLS) model and the State-of-the-Art Contingency Analysis (SOTACA) were fielded under MAPP. SOTACA is no longer in use and JTLS receives limited use. The TACWAR model, though not a MAPP product, has replaced JTLS in several organizations. The MAPP effort is a clear recognition that CINCs need analysis aids to assist planning.[12]

There are other models available (or under development) in

the joint community which could be used by a CINC to help accomplish planning. The Auto Force Generator (AFG) allows users to build Time-Phased Force and Development Data (TPFDD) on a stand-alone workstation. Planners are able to tailor joint forces to fit any scenario. The Force Module Logistics Sustainability Model (FMLSM) will determine the munitions sustainability of forces by comparing consumption requirements to available assets. Tabular and graphical outputs are available by service. The Wartime Host Nation Support Information Management System (WHNSIMS) will provide an automated capability to track and manage host nation support information. This model will support the CINCs host nation support information requirements by providing data in the areas of combat support, combat service support, facilities and services. The Force Augmentation Planning and Execution System (FAPES) is under development and will determine whether force augmentation is necessary to satisfy the time-phased requirements of deployment and sustainment operations.[13] These models are part of the JOPES enhancement process and are designed to satisfy some of the information needs of CINCs and other senior decisionmakers.

AUTOMATED DECISION SUPPORT SYSTEM TECHNOLOGIES

A search was conducted to determine what automated technologies are available or under development which could assist CINC level commanders to process, display and assimilate

information in terms of decision aids, decision support systems or command and control systems. Appendix A contains a list of the agencies that were contacted along with their products. Although some work has been done to determine what the information needs and critical information requirements (CIR) are for a CINC, there is not sufficient information available to create the systems required for theater or global planning. The Command and Control Decision Aid Information System (C2DAIS) database contains information about C2 decision support systems in the services. C2DAIS provides up-to-date information on approximately 100 decision support system titles. These titles are cataloged by several methods and include CINC and service - level aids for different functions (e.g., deliberate planning, crises planning). These 100 titles resulted in a half-dozen which looked promising.

After discussions with developers and reading documentation, none "fit the bill" for a system that would interface between the user and the application being run (wargame, simulation, etc.). The C3I community understands the need for automated decision support systems and efforts are being made in that regard, but products are not developed to the point of being usable and some agencies lack funding to continue development. DOD, in general, and the Army, specifically, have multiple agencies working various parts of the command and control equation (decision support systems are but one part of the C2 equation). This creates duplicate work and the thinning of already scarce resources.

CINCs have clearly identified needs for automated systems which aid them in their responsibilities to help obtain national military objectives. Automated systems which are needed include analytical tools, simulations and decision aids to support the decision and planning process.

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CHAPTER IV

SYSTEM CONCEPT TO SUPPORT A C2DSS

"Decision support systems offer an opportunity that is both trivial and immense - immense in that they can embed the computer in decision making activities where they provide large payoffs and trivial in that they represent no major advance in technique."[1] Decision support systems impact on and provide a payoff to the organization and to their relevance to management. A C2DSS impacts on decisions where the structure exists for computer applications to be of value but the manager's (commander's) judgment is essential to the process. The payoff is in the manager's (commander's) improvement in effectiveness by enhancing the decision making process. A system's relevance is in the fact that the C2DSS is a support tool for management and not a decision process that imposes solutions.[2]

COMPUTER GRAPHICS DESIGN PRINCIPLES

Computer graphics technology is having a significant impact on decision support systems, decision aids and command and control systems. Graphic displays present resources, situation maps, performance data and a variety of other battlefield decision displays. Complete graphic displays summarize large

quantities of data and have the potential to help the user process and manage information. The effectiveness and contribution of computer graphics in decision support systems are influenced by the user interface part of the C2DSS. The interface links the user to the model and determines how the user and model will communicate. Interface systems should be designed to support the user's cognitive, perceptual and motor functions.[3]

The U.S. Army Research Institute has completed research on the design of computer graphic interface systems. The results of this research are contained in a report titled Human Factors Guidelines for Command and Control Systems: Battlefield and Decision Graphics Guidelines. The report focuses on the presentation of graphical charts used to display battlefield operations and data in a manner that increases perception, understanding and use. Guidelines are provided "about these aspects of graphic presentation, interactive dialogue and screen format and display characteristics which affect the efficiency with which the user can: (1) process information from computer-generated graphic displays; (2) modify graphic displays; and (3) communicate with the computer to execute user requests."[4] This document should be used by the USAWC and programmers for the design of the graphical portions of the C2DSS interface.

A SYSTEM CONCEPT

The system concept for a USAWC C2DSS involves more than a menu driven system which provides interface between the user and the application. It consists of three dimensions: the hardware suite; the software suite; and the USAWC philosophy for using the system. The hardware suite in the SWF consists of the type of computers described in Chapter II and the additional peripherals required to install the system (e.g., local area network hardware, workstations, printers). Additional mini/micro computers will be required, but the USAWC does not plan to purchase a mainframe computer for the SWF. All the software applications (wargames, simulations, models) must, therefore, run on mini and micro computers.

The software suite consists of two main parts. One part is the suite of applications installed on the hardware which supports the SWF mission. These missions are spelled out in General Vuono's terms of reference for the USAWC. In order to accomplish the mission, the software suite will have to be expanded with additional applications. The current suite, as described in Chapter II, is sufficient for the wargaming requirements using the RSAS and TACWAR models. Additional applications which are in use by the Army and DOD (or applications that provide similar results) are required to support requirements other than wargaming. It will be difficult

to identify or build additional applications until the academic departments identify requirements.

The second main part of the software suite is the software interface system, the C2DSS. The C2DSS need and requirements are described in the CSW C2DSS Requirements Document. As previously pointed out, this document spells out what the C2DSS should look like on a workstation screen and what features this menu driven system should possess. However, the design of the software interface is often the most difficult part of a decision support system. The user sees the interface as the total system. The designer of the software should consider the communicability and robustness of the interface. Communicability means that the system must be conversational with a simple process for inputting information and requiring brief responses and little typing. Robustness means that this system should be "foolproof" and reliable. A carefully thought out plan is required for the interface to satisfy these conditions.[5]

Beneath the screen display, the C2DSS software will be required to accomplish two tasks. One task is to receive input from the user (campaign plans, alternative actions, parameters, data, etc.) and the second task is to provide output to the user (graphs, charts, status displays, parameter data, etc.).

The first task, to define user input, can be accomplished in two ways. The CSW personnel, using their knowledge of the information required to run an application, can define the input required by the user. Secondly, the teaching departments can

identify requirements and objectives and the input is defined to satisfy department requirements. In either case, the input portion of the C2DSS menu is constructed after requirements are identified.

The second task, provide output to the user, requires a definition of the output. As in the first task, CSW can define the output or the teaching departments can define the output in terms of requirements and objectives. In other words, what results does the user need to see and how will these results be displayed? Once the output requirements are defined, data from the application is obtained and transformed into the appropriate output (charts, graphs, tables, etc.). This can be accomplished by "dumping" application files into a software package that manipulates data, performs statistical analysis and creates formatted output. These software packages are available commercially or can be programmed to fit specific needs. The great advantage of a commercial package is that reprogramming is not required to modify or add an output product.

The USAWC philosophy and approach to using computer applications in the future will determine the success or failure of the C2DSS. In the past, the USAWC has not considered computer applications critical to its mission or future. In fact, the same statement is true today from a curriculum standpoint and from a standpoint that USAWC wargaming and modeling effects have not impacted the Army. The curriculum is lacking and the Army does not look at the USAWC as its preeminent

wargaming center. With the new SWF in 1994, the CSW vision for USAWC 2000, General Vuono's terms of reference and a change in the philosophical approach to wargaming and modeling, the USAWC will become the preeminent wargaming and strategic thought center in the Army and possibly DOD. The SWF is on-track, the CSW vision is clear and General Vuono's guidance is clear. The philosophical approach needs modification.

PHILOSOPHICAL APPROACH

The Army is investing resources in the development and fielding of simulations that train and educate commanders and staffs from the platoon through echelons above corps level. The National Simulation Center (NSC) was created at Fort Leavenworth to integrate and focus these efforts into a concept called the Family of Simulations (FAMSIM). The FAMSIM provides the wargames and models designed to support simulation at each training level. Models exist and training is being conducted at all levels through corps. There are efforts under way to develop training simulations for echelons above corps, but useful products are years and millions of dollars away. The NSC approach to command and staff training and education is to conduct hands-on, performance-oriented exercises.

The USAWC approach to using simulations in the education of students should be directed toward hands-on, performance-oriented exercises. This will require a change in the current thought

process concerning the use of simulations. As a first step, the academic board will have to make time available in the curriculum and support some degree of "role playing" by students. The great majority of USAWC students have never been inside the LSL, much less have any idea of its capabilities. During the early part of the academic year, CSW conducted an overview briefing of CSW activities and a tour of the LSL. The briefing/tour was optional for students and out of the four briefings/tours set up over the course of a month, two or three students out of 280 participated. The Army approach to computer-assisted command and staff training is role-playing, even though in many cases the role being played is the individual's current job. Role-playing works and is institutionalized within TRADOC for command and staff training and education.

Throughout the curriculum there are areas where computer applications would enhance the education process. These areas should be identified and computer applications reviewed and obtained, if practical. There are many computer applications in use by the Army, the CINCs and DOD that could support the curriculum. For each of these areas, an exercise would be developed paralleling the actual process using the computer application as the exercise driver. Each seminar would be organized to support a particular exercise, e.g., a national level exercise, a CINC level exercise or an Army level exercise. Each student has a defined position in the exercise. A student might play the Secretary of Defense in one exercise, play a CINC

in another and play an Army deputy chief of staff in yet another exercise. Students would receive hands-on experience as each position has access to the computer applications that are owned and operated by the position through the C2DSS. The processes are played out (issues discussed, courses of action compared, plans developed, recommendations made, etc.) by each seminar in as close to a realistic exercise as possible. Students would obtain a feeling for the problems and issues facing strategic leaders and affecting strategic thought, plus gain valuable experience attempting their resolution. Students would become familiar with the processes and associated tools. Of course, the academic department faculty instructors should be familiar with any computer model that is used in his/her specific area.

The current approach to using computer applications in the curriculum is based on the philosophy that students do not need to know anything about the models; that students do not really need to know that a model produced the results. The curriculum calls the models "transparent" because, to the student, the models do not exist. Model transparency has another definition - the senior leader or executive understands the capabilities and limitations of the model and "trusts" it to provide reasonable results given reasonable input. The model then becomes transparent to the senior leader because he understands where and how results were obtained.

Prior to the start of a course or exercise, each application would be briefed to the students. Capabilities and limitations

would be covered and students would obtain a feel or understanding for the application. Students would not go into computer-assisted exercises blind of the applications being used. Students would become model proponents through an understanding and appreciation of the models. There are entirely too many senior leaders in DOD who mistrust all computer output because of a lack of education. The USAWC should educate future senior leaders in this area. It is difficult to trust something that is not understood.

SUMMARY

Along with this philosophical approach to education, the USAWC becomes the center for strategic wargaming and thought for the armed forces. Students and faculty members recommend improvements to the processes, changes to the applications and the C2DSS grows in stature and capability. The C2DSS would be exported to other education institutions, Army headquarters and CINCs. A laboratory environment would be created for developing ideas and concepts for using computer-assisted applications in the education of the Army's future leaders.

The system that the USAWC needs is more than a C2DSS to facilitate student interface with computer applications. It is a total package that supports the education process and enhances the USAWC position as the center for strategic thought in the armed forces.

ENDNOTES

1. Peter G.W. Keen and Michael S. Scott Morton, Decision Support Systems: An Organizational Perspective, p. 242.

2. Ibid., p. 2.

3. U.S. Army Research Institute for the Behavioral and Social Sciences, Human Factors Guidelines for Command and Control Systems: Battlefield and Decision Graphics Guidelines, p. 1.

4. Ibid.

5. Keen and Morton, pp. 182-183.

CHAPTER V

RECOMMENDATIONS

The USAWC has a long history of using wargames as instructional aids. With the computer age, it has incorporated computer-assisted exercises into the curriculum. Applications (wargames, simulations, models, etc.) did not remain in the curriculum and expand and improve. The wargaming facilities are inadequate in terms of size and capabilities to support all the students.

Computer-assisted applications are in the Army to stay and their use will grow in the future as a means to conduct quality training and education at reduced costs. The importance of current and emerging technologies as education tools is understood by educators and senior leaders in the military and the private sector.

The mission of the USAWC is clear and the guidance is precise from the Army Chief of Staff in terms of wargaming and strategic thought. The USAWC 2000 vision is the foundation toward making the USAWC the preeminent center for strategic thought in the armed forces. The need for a Strategic Wargaming Facility is well documented. The path to preeminence does not follow the path of least resistance. Innovations and commitments are required by the entire War College community. What is the

USAWC product and why is the institution in business? There could be several answers to this question, but the reason the USAWC exists is to educate and train the Army's future senior leaders at the strategic level. The USAWC product is an officer or civilian who is both technically and tactically competent at the strategic level. If the USAWC turns out poor products, the future quality of the Army is reduced.

To continue to send quality products back to the Army in the years ahead, the USAWC must institutionalize the use of wargames, simulations and models as standards in the curriculum. This will require a modified or changed philosophy and the adaption of a systems approach to using computer-assisted applications. It consists of the hardware suite to be placed in the new SWF, the software suite of applications to be installed on the hardware and a commitment by the USAWC to institutionalize a philosophical approach to using computer-assisted applications in the curriculum. The specifics of these three dimensions were spelled out in Chapter IV.

In addition to adopting this systems concept as the umbrella architecture for the C2DSS, other recommendations are in order. A survey should be conducted to determine what applications are in use or in development that would support the curriculum. This survey could be accomplished by an Army analytical agency or contractor. The USAWC should then determine which applications will be used or modified for inclusion into the curriculum. Based on the final list of wargames, simulations and models, the

C2DSS should be designed using the requirements document and graphic design principles. The education of the Army's future senior leaders should be such that computer applications are "transparent" to the senior leader. That is, the senior leader should understand the applications and give the resulting product credibility. (Lack of product credibility often results from senior decision makers not trusting the tools used by the analytical community.) The USAWC should take the lead in training at echelons above corps using the SWF and this systems concept. Support to the warfighting CINCs is essential and the USAWC should accomplish this by becoming a test bed for wargaming, simulations, models and decision support systems. As applications are used and tested, MAPP products are enhanced and provided to the CINCs.

This entire concept should be adopted and written into the USAWC 2000 vision. The entire three dimensional system, the software suite, the hardware suite and the philosophical approach, should be the umbrella for the C2DSS. The C2DSS will be a product that is used in the USAWC's education mission and in its role to support the Army. If this concept is not adopted and institutionalized, when the current Army and War College leadership moves on, the emphasis will change and a great opportunity will have been lost.

APPENDIX A

AUTOMATED TECHNOLOGIES

This appendix contains a listing of the agencies contacted and their products which were examined during the research of this paper. These products were examined because of the possibility that they could help senior-level commanders process, display and assimilate information in the form of decision aids with the result being enhanced command and control.

Army Research Institute for the Behavioral and Social Sciences, Fort Leavenworth Field Unit, Fort Leavenworth, KS. **Course of Action Assessment Tool (COAAT).** POC is Mr. Jon Fallesen, AV 552-4933. COAAT is a computerized aid for assisting tactical operations personnel in course of action assessment.

Army Research Institute for the Behavioral and Social Sciences, Fort Leavenworth Field Unit, Fort Leavenworth, KS. **Operations Planning Tools (OPT).** POC is Mr. Jon Fallesen, AV 552-4933. OPT is a decision support system that supports the development, evaluation and comparison of tactical courses of action.

Army Strategic Defense Command, Battle Management Division, Huntsville, AL. **Command and Control Decision Aids Test Environment (C2DATE).** POC is Mr. Michael Gately, AV 645-4945. C2DATE will assess the feasibility and applicability of knowledge based decision aids and, if feasible, design, develop and test the capability to develop decision aids.

Center for Command, Control and Communications Systems, U.S. Army CECOM, Fort Monmouth, NJ. **The Command and Control Reference Model (C2RM).** POC is Mr. Israel Mayk, AV 995-4996. C2RM provides a framework to describe intelligent C2 systems and the way they resolve uncertainty.

Combined Arms Command, Future Battle Laboratory, Fort Leavenworth, KS. **AirLand Battle Management Advanced Technology Transition Demonstration Program (ALBM ATTD).** POC is MAJ Bob Reyenga, AV 552-2034. The ALBM ATTD will apply ALBM and related technologies to determine user requirements for automated decision aids for planning and to develop prototypes of these aids.

Combined Arms Center, Fort Leavenworth, KS. **Battle Command Integration Program (BCIP).** BCIP provides training for division and corps commanders and their staffs through command post exercises using a wargame as the driver.

Combined Arms Combat Development Activity (CACDA), Fort Leavenworth, KS. Army Command and Control Master Plan (AC2MP). AC2MP is the strategy for the management and development of the Army Command and Control System.

Combined Arms Combat Development Activity (CACDA), Fort Leavenworth, KS. **Maneuver Control System (MCS).** POC is LTC Timothy M. Schmidt, AV 552-4283. MCS is one of the five systems that make up the Army Tactical Command and Control System and links commanders at corps through maneuver brigade and separate battalion.

Combined Arms Combat Developments Activity (CACDA), C2 Directorate, Fort Leavenworth, KS. **Theater Army Command and Control Information Architecture.** POC is Mr. Stucker, AV 552-3433. This effort will define the theater Army C2 mission and determine the information required to support the mission.

Command and Control Microcomputer User's Group (C2MUG), Fort Leavenworth, KS. **Command and Control Decision Aid Information System (C2DAIS).** POC is Mr. Marc Gordon, AV 552-2252. C2DAIS is a database of information about C2 decision support systems in the Army, Navy and Air Force.

Defense Applied Research Projects Agency (DARPA), Warfighting/ Simulations/C3 Directorate. POC is LTC Pullen, AV 224-9173. DARPA is not working on any decision support system for senior-level commanders.

I Corps Battle Simulation Center (BSC), Fort Lewis, WA. POC is Mr. Johnny Ring, AV 357-8581. The BSC has not developed any decision aids beyond what is provided by the models used during the training exercises.

Joint Warfare Center, Hurlburt Field, FL. **State of the Art Contingency Analysis (SOTACA).** POC is MAJ W.L. Campbell, AV 579-7351. SOTACA is a MAPP product that was designed for the rapid evaluation of courses of action at the JCS and CINC level. The model is not functioning properly and not actively used.

National Simulation Center, Fort Leavenworth, KS. **Joint Exercise and Support Overview (JESS).** POC is LTC Flanagan, AV 552-3180. JESS is the computer battle simulation that supports the Battle Command Training Program and all the corps battle simulation centers.

Office of the Joint Chiefs of Staff, J-4, The Pentagon. **CINCs Critical Items List Software.** POC is LTC Larry Lovell, AV 225-9234. This program provides an integrated decision process to prioritize a CINCs critical items list.

Office of the Joint Chiefs of Staff, J-8, The Pentagon. **Modern Aids to Planning Program (MAPP).** POC is LTC Michael Baxter, AV 225-1762. MAPP does not contain any new developments in the area of decision aids or command and control for the CINC or higher commands.

Office of the Joint Chiefs of Staff, JGE, The Pentagon. **Joint Decision Support System (JDSS).** POC is Mr. C. Sutherland, AV 227-8588. JDSS assesses CINC and global C3 capability and prioritizes C3 programs based on mission analysis.

Pacific Air Forces, TACF/PQ, Hickman AFB, HI. **CINCPACAF Integrated Decision Support System (CIDSS).** POC is MAJ David Owens, AV 449-1717. CIDSS supports crises action planning by accessing data bases and displaying selected data in formats which support the CINCs decision making capab lity.

Rome Air Development Center, Griffiss AFB, NY. **Enemy Course of Action Evaluation Aid.** POC is Mr. Roger Ward, AV 587-2902. This tool predicts enemy course of action by determining the most likely destination of enemy follow-on ground divisions.

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